

REMARKS

The office action mailed August 16, 2006 has been carefully reviewed and these remarks are responsive thereto. Claims 2, 4-21 and 23-25 are pending and stand rejected.

May 5, 2006 IDS

The office action did not include an initialed copy of the information disclosure statement (IDS) submitted on May 5, 2006. Applicant requests that the next office action include an initialed copy of said IDS.

The Claims

The office action rejected claims 2 and 4-7 under 35 U.S.C. § 103 based on U.S. Patent 5,675,329 (Barker et al., hereinafter "Barker"). Applicant respectfully traverses.

Independent claim 4 recites a detection circuit that comprises a microprocessor and a voltage divider. Barker does not teach or suggest a voltage divider. The office action tacitly concedes this on page 4:

It is well known in the art to include a voltage divider with a force detection circuit.

It would have been obvious to one with ordinary skills in the art at the time the invention was made to include with the force detection circuit as taught of Barker a voltage to provide an easy and well known method to control the voltage going through the circuit.

The previous office action argued that the force detection circuit of Barker could be replaced with "the force detection circuit including a voltage divider as taught by Omura [U.S. Patent 5,349,873]." February 14, 2006 office action at page 9. As Applicant noted in his May 12, 2006 amendment, the combination of Barker and Omura was improper. Omura is from a non-analogous art. Barker relates to measuring of force on a QWERTY keyboard, while Omura relates to force transducers that are usable under the severe operating conditions found in an engine cylinder. See, e.g., Omura col. 1, lines 18-26. The Office apparently recognized the impropriety of combining Barker and Omura and has not argued that specific combination in the latest office action.

Instead, the present office action now seeks the same result by claiming that it was "well known in the art to include a voltage divider with a force detection circuit." Even if use of a

voltage divider with a force detection circuit was known by persons of ordinary skill in unrelated arts (such as that of Omura), the office action has not established that such a combination was known to persons of ordinary skill in the art of computer keyboards (i.e., the art applicable to Barker). Applicant does not consider this combination to have been common knowledge in the art of computer keyboards. If the Office maintains this grounds for rejection, Applicant requests that the Office provide evidence to support any assertion that it was well-known in the *relevant art* (i.e., the art applicable to the reference sought to be modified) to include a voltage divider in a force detection circuit. See MPEP § 2144.03 C. ("If Applicant Challenges a Factual Assertion as Not Properly Officially Noticed or not Properly Based Upon Common Knowledge, the Examiner Must Support the Finding With Adequate Evidence").

There are also deficiencies in the currently-asserted motivation for combining Barker with alleged "well known" teachings in the art. According to the office action, a person of skill in the art would have made such a combination with Barker so as "to provide an easy and well known method to control the voltage going through the circuit." If this ground for rejection is maintained, Applicant respectfully requests clarification concerning this alleged motivation so that Applicant will have a fair opportunity to respond.

- To which "circuit" does the office action refer? Barker does not provide specifics of the actual circuitry used to measure force on a key. At most, Barker describes a preferred embodiment in which "force sensing device 12 comprises a force sensing resistor, wherein the resistance of the force sensing resistor changes as a function of pressure load placed on it, and a power supply coupled to the force sensing resistor." Barker col. 2, lines 57-62.
- At what point in the Barker "circuit" does the office action propose adding a voltage divider?
- Why would there have been a need to "control voltage" in the circuit?
- Assuming there would have been a need to control voltage in the circuit, why would a person of ordinary skill have been motivated to use a voltage divider instead of some other method?

As a final point regarding claim 4, the office action does not even address a portion of the claim. Specifically, claim 4 recites that "the microprocessor is configured to place the voltage divider in a first condition when scanning each key of the plurality to determine if a scanned key is in a pressed condition and in a second condition when quantifying the force exerted by a user on a key determined to be in a pressed condition." The office action only refers to first and second conditions on page 4, not to placing the voltage divider in first and second conditions. Even if there is some argument supporting modification of Barker to include a voltage divider in a force detection circuit, the office action does not explain why a person of ordinary skill would have been motivated to include a voltage divider that can be placed in multiple conditions as recited in claim 4. Barker includes no teaching or suggestion of such a motivation.¹

For at least the above reasons, claim 4 is allowable. Claims 2, 5 and 6 depend from claim 4 and are allowable for at least the same reasons as claim 4.

Independent claim 7 recites that "the detection circuit comprises a microprocessor and a RC network." In rejecting claim 7, the office action (referring to Barker) makes the following statement at page 3:

In column 2, line 57 and 59; he mentions that his apparatus is able to incorporate capacitive technologies and a force sensing resistor; since the definition of an RC network is basically a circuit that encompasses at least one resistor and one capacitor; Barker teaches that the detection circuit includes an RC network {claim 7}.

The office action mischaracterizes Barker. In actuality, Barker states the following at column 2, lines 55-62:

¹ Although the office action did not apply the Olodort reference (U.S. Patent 6,563,434) to claim 4, Applicant notes that Olodort also fails to teach a voltage divider that can be configured by a microprocessor as recited in claim 4.

55 **converts the pressure into an analog voltage. Force sensing
device 12 may be employed using piezo and foil strain
gauges, optical, magnetic and capacitive technologies. In the
preferred embodiment, force sensing device 12 comprises a
force sensing resistor, wherein the resistance of the force
60 sensing resistor changes as a function of pressure load
placed on it, and a power supply coupled to the force sensing
resistor.**

As seen above, Barker does not state that the described device is able to incorporate capacitive technologies and a force sensing resistor. Instead, the only reasonable interpretation of the above passage is that the force sensing device in Barker may be implemented using piezo gauges, *or* using foil strain gauges, *or* using optical technologies, *or* using magnetic technologies, *or* using capacitive technologies, *or* using a force sensing resistor.

Because Barker does not teach all features of claim 7, claim 7 is allowable.

The office action rejected claims 8-21 and 23-25 under 35 U.S.C. § 103 based on Barker in view of U.S. Patent 6,563,434 (Olodort et al., hereinafter "Olodort"). Applicant respectfully traverses.

Claim 8 recites a computer keyboard comprising

a grid of first group conductors and second group conductors, the first and second group conductors forming a plurality of intersections;

a force-sensitive resistive element at each intersection of the plurality located between one of the conductors of the first group and one of the conductors of the second group forming said intersection;

a plurality of keys located above the plurality of intersections, each key being associated with one intersection and configured to exert force on the conductors and force-sensitive resistive element of the associated intersection during a key press;

a microprocessor having a plurality of first group conductor pins each in contact with one of the first group conductors and a plurality of second group conductor pins each in contact with one of the second group conductors;

a sub-circuit connected to at least one of the second group conductors, the sub-circuit having a resistor network switchable by the microprocessor between a low resistance value and a high resistance value; and

an Analog to Digital Converter (ADC) coupled to the sub-circuit and to the microprocessor.

The office action acknowledges at page 6 that Barker fails to teach a "force-sensitive resistive element at each intersection of the plurality" and other features of claim 8. The office action then seems to assert that a person of ordinary skill in the art would have been motivated to modify Barker--prior to combination with Olodort--to include a force-sensitive resistive element at each of a plurality of conductor intersections, with each intersection corresponding to an associated key.² For convenience, this modified version of the Barker device will be called "the pre-combination modified Barker device." The office action next argues that a person of skill in the art would have been further motivated to combine the pre-combination modified Barker device with a device described in Olodort Fig. 40.

The office action fails to provide a motivation for such a combination, as the pre-combination modified Barker device and the embodiment of Olodort Fig. 40 operate in fundamentally different ways. See MPEP § 2143.01 V. ("The Proposed Modification Cannot Render The Prior Art Unsatisfactory For Its Intended Purpose") and VI. ("The Proposed Modification Cannot Change The Principle Of Operation Of A Reference"). In order to understand this difference, a brief review of Olodort is helpful.

Set forth below is a copy of Olodort Fig. 40:

² The office action asserts that "[i]t is known in the art to include a grid of first group conductors and a second group conductors, the first and second group conductors forming a plurality of intersections; a force-sensitive resistive element at each intersection of the plurality located between one of the conductors of the first group and one of the conductors of the second group forming the intersection." Office action at 6-7. The office action then argues that "[i]t would have been obvious to one with ordinary skill in the art at the time the invention was made to combine have the force detection circuit be between two conductive layers which corresponds to an associated key with the force detection circuit of Barker in order to detect the force exerted upon each of the keys on the keyboard."



The "keyboard bus" 601 through 607 correspond to the "conductors" 601 through 607 shown in Fig. 39. Olodort Fig. 39 shows a keyboard assembly having an array of keys 640 coupled by conductors 601-607 to the keyboard interface 600 of Fig 40:



Additional details of the individual keys are provided in Fig. 41, which "shows an example of keyboard 640 with three rows of eight keys each." Col. 18, lines 63-64.

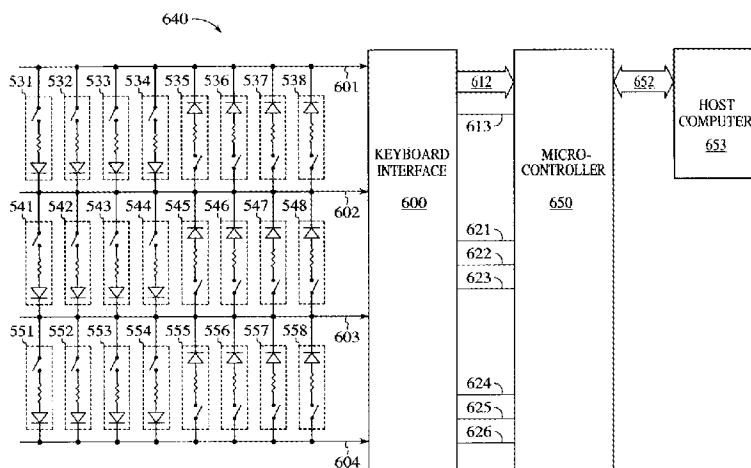


FIG. 41

As seen above, a diode, a resistor and a switch is associated with each key (see, e.g., key 531).

In operation, the microcontroller 650 uses address signals 621-623 to control multiplexer 608 and address signals 624-626 to control multiplexer 609. Col. 18, lines 31-40. Specifically, microprocessor 650 reads a portion of one row of keys by connecting one of the conductors for that row (e.g., bus 601) to current source 610 and grounding the other conductor for that row (e.g., row 602). Col. 18, lines 31-40 and 52-62; col. 19, lines 1-12. Some of the diodes within the row will be forward biased and permit current to flow between the conductors if a corresponding key is pressed to close the switch. Fig. 41; col. 19, lines 8-12. Other diodes in the row will be reverse biased, and pressing a corresponding key will have no effect. Id. The resistors in each of the keys with forward-biased diodes has a different value, and the microcontroller 650 determines which key (or keys) is (or are) pressed based on current drop across resistor 614 (Fig. 40). Col. 19, lines 13-17. The microcontroller 650 then analyzes other keys in the same row (i.e., keys with diodes oriented in the opposite direction) by changing the polarity of the row conductors (e.g., by grounding conductor 601 and connecting conductor 602 to current source 610). Col. 19, lines 17-22. The other rows are scanned in a similar fashion. Col. 19, lines 25-27.

The embodiment of Olodort Figs. 39-41 requires that each key in a scanned group of keys have a specific and known resistance value in order to identify the pressed key (or a collection of

pressed keys). See Olodort col. 19, lines 15-17 and 33-37. As can be readily appreciated, this is fundamentally different from a system in which a pressed key can have a variety of resistance values that are not known in advance. Yet, variable resistance for a particular key is essential to operation of the pre-combination modified Barker device. If the pre-combination modified Barker device were to have fixed resistance values for pressed keys, the key forces could no longer be measured. Conversely, placing force-sensitive resistors in the keys of Olodort Figs. 39-41 would interfere the described method of key identification.

Because the office action fails to provide a sufficient motivation for a person of ordinary skill to have combined Barker and Olodort, claim 8 is allowable. Claims 9-16 depend from claim 8 and are allowable for at least the same reasons as claim 8, and further in view of additional recited features.

For example, claim 9 recites that the microprocessor is configured to test a conductor pin for a threshold voltage level while the resistor network is switched to the high resistance value, to switch the resistor network to the low resistance value upon detecting the threshold voltage level on the tested conductor pin, and to receive from the ADC a digital value of a voltage on the tested conductor pin while the resistor network is switched to the low resistance value. The office action argues that

As for claim 9, Olodort teaches of the microprocessor (650).

ground to an individual conductor pin (column 19, line 8),

test another conductor pin for a threshold voltage level while the resistor network (Fig. 41) is switched to the high resistance value (binary value 1, aka, while the bus is grounded and hence in a high resistive state, the circuit is able to detect if any of the keys are pressed, column 19, line 9),

switch the resistor network to the low resistance (binary value 2) value upon detecting the threshold voltage level on the tested conductor pin in column 19, lines 13-20, and

receive from the ADC (611) a digital value of a voltage on the tested conductor pin while the resistor network is switched to the low resistance (binary value 1) value in column 19, lines 13-20.

Office action at 7-8.

Although somewhat unclear, the above passage indicates that the office action treats analog multiplexer 608 and/or analog multiplexer 609 as the resistor network recited in claims 8 and 9. Even if multiplexers 608 and/or 609 could be treated as a resistor network,³ however, other features of claim 9 are not met. Specifically, claim 9 recites that the microprocessor is configured to switch the resistor network to the low resistance value *upon* (i.e., as a result of) detecting the threshold voltage level on the tested conductor pin. Olodort does not teach or suggest that the input signals to multiplexers 608 and 609 (via address signals 621-626) are changed *as a result of* some detected voltage. On the contrary, Olodort suggests that those address signals are changed cyclically (on a timed basis) as part of scanning the entire keyboard. See Olodort col. 18, lines 52-55; col. 19, lines 25-32. To the extent the office action actually treats some other component(s) in Olodort Figs. 40 and/or 41 as the claimed resistor network, Olodort still fails to teach switching such a network to a low resistance value *upon* detecting a threshold voltage level.

Independent claim 17 similarly recites a microprocessor having preprogrammed instructions for performing steps that include "upon detecting the threshold voltage level on the selected conductor pin, placing the detection circuit in a second state by altering the resistance of a resistance network." The office action merely cites to Olodort Fig. 41, "binary level 2," and Olodort column 19, line 22 when addressing this portion of claim 17. Curiously, the office action cites col. 19, lines 13-20 as teaching the portion of claim 9 similar to the "upon detecting ..." portion of claim 17. Both sections are included in the below-reproduced passage from Olodort column 19:

³ In actuality, each of those multiplexers simply acts as a switch. Multiplexer 608 connects or disconnects each of conductors 601-607 to current source 610.

bus since their diodes are reverse biased. Since each of the keys, **531**, **532**, **533**, and **534** have a different resistor value, microcontroller **650** can determine which keys are pressed by analyzing the current flow as measured by the voltage drop across resistor **614**. Microcontroller **650** then analyzes keys **535**, **536**, **537**, and **538** by setting row address signals **621**, **622**, and **623** to a binary value of two and row address signals **624**, **625**, and **626** to a binary value of one. This reverses the polarity by connecting bus **602** to current source **610** and bus **601** to ground. In this state, keys **531**, **532**, **533**, and **534** have no effect and current flow through keys **535**, **536**, **537**, and **538** can be analyzed to determine which of the keys are pressed. This cycle completes scanning of the first row of keys and the remaining rows are scanned in a similar fashion. When microcontroller **650** finds a depressed key, it uses a table look-up method to locate the scan code for the key and sends the scan code to host computer **653** or other host device. This entire scanning process repeats indefinitely, causing the keyboard to be continuously scanned.

The above passage is completely silent as to placing a detection circuit in a second state, by altering the resistance of a resistance network, *upon* (i.e., as a result of) detecting a threshold voltage level on a selected conductor pin. Accordingly, claim 17 is allowable.

The office action also fails to provide a proper motivation for a person skilled in the art to have combined Barker and Olodort. The office action only states:

It would have been obvious to one with ordinary skill in the art at the time the invention was made to combine the sub-circuit of Olodort with the force detection circuit of Barker in order to a more space efficient way to detect key actuation in a keyboard assembly (see column 2, line 33).

Office action at 11. However, the portions of Olodort relied upon to reject claim 17 (electrical elements of Olodort Fig. 41) have nothing to do with "a more space efficient way to detect key actuation in a keyboard assembly." The potential space savings described by Olodort are the result of the collapsible key structure shown, e.g., in Figs. 1-10 and 13-24B. The circuitry described in connection with Olodort Figs. 39-41 is used to identify pressed keys. Although the

circuitry of Figs. 39-41 may be usable with such a collapsible structure, Olodort does not teach or suggest that the detection circuitry (in and of itself) allows space savings if it is used without the collapsing key structure.

Because the office action does not provide a proper motivation for a Barker/Olodort combination, claim 17 is allowable for this additional reason. Claims 18-21 and 25 depend from claim 17 and are allowable for at least the same reasons as claim 17, as well as because of additional recited features. For example, claim 19 recites that the microprocessor of claim 17 includes additional preprogrammed instructions for storing an identifier for *multiple* pressed keys, storing force measurements for the *multiple* pressed keys and generating a data message containing the stored identifiers and force measurements. The office action wrongly asserts that these features are taught by Barker. Nothing in Barker teaches or suggests a data message -- i.e., a *single* data message -- with key identification and key force data for multiple keys. Instead, Barker teaches that key data is received for one key at a time.

Claim 23 depends from claim 4, and recites that "placing the voltage divider in the second condition comprises altering a resistance value in a portion of the voltage divider." The office action argues at page 11 that

As for claim 23, Olodort teaches of placing the voltage divider (614, 618) in the second condition (binary level 2) comprises altering a resistance value in a portion of the voltage divider (614, 618), the altered resistance value portion not including one of the force sensitive resistive elements in column 19, line 8 and line 19.

As can be seen on Olodort Fig. 40 (reproduced above), a voltage divider is formed by resistors 617 and 618. However, Olodort does not teach or suggest that the resistance value (i.e., value in ohms) of either portion of that voltage divider is ever altered.⁴ Accordingly, claim 23 is also allowable.

⁴ Olodort does state at col. 18, lines 40-41 that "[r]esistor 614 and 618 create a voltage divider to generate a reference voltage signal 619," but this appears to be an obvious typographic error. Clearly, resistor 614 is part of the negative feedback loop for operational amplifier 616 and does not form a voltage divider with resistor 618. Even if resistors 614 and 618 could be considered a voltage divider, Olodort does not teach that the resistance value of resistor 614 is ever changed.

Claim 24 depends from claim 7, and recites that the microprocessor is configured to determine force exerted on one of the associated keys based on a time constant for the RC network. The office action correctly states that neither Barker nor Olodort includes "any mention of using a time constant from an RC network in order to configurate [sic] the force exerted on the keyboard." Office action at 12. The office action then states:

Examiner takes official notice that it is well known in the art to have microprocessor configured to determined force exerted on one of the associated keys based on a time constant for the RC network.

Applicant does not believe it was well known in the art of computer keyboards (at the time of Applicant's invention) to determine key force based on an RC network time constant. If the Office maintains this grounds for rejection, Applicant requests that the Office provide evidence to support the assertion of such knowledge. See MPEP § 2144.03 C.

It is respectfully submitted that this application is in condition for allowance. Should the Examiner believe that anything further is desirable in order to place the application in even better form for allowance, the Examiner is respectfully invited to contact Applicant's undersigned representative at the below-listed number.

Respectfully submitted,

BANNER & WITCOFF, LTD.

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